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THE SECONDARY EMISSION MONITOR REPAIR

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The only device that we are using for monitoring the intensity of the slow spill Proton beam is the SEM (secondary emission monitor). In the Proton area the SEM has been used since 1973. At present there are three SEM's in the Proton West and the High Intensity Area, and one each in Proton East and Proton Center.

The SEM consists of alternating thin foils of high voltage and collecting plates in a high vacuum container. The high vacuum of 10^{-8} Torr is maintained by an 8 liter/second VacIon pump. When the relativistic Proton beam traverses the foils it liberates the surface electrons. These low energy electrons are deflected by a high voltage electric field toward the collector plates as the output signal.

The VacIon pump has a rated life time of 40,000 hours or three and one half years. It is no wonder that we have a few SEM's whose VacIon pump is either sparking or unable to pump down. With the cost for a new SEM on the order of $10K, we have designed an apparatus to replace the defective pumps.

Since the foils are coated with thin films of silver or gold, it is important that the SEM not be exposed to air. Oxidation and hydrocarbon chemicals can alter the work function of the foils thus altering the sensitivity of the response. A special glove box has been designed for this purpose, so that the VacIon pump can be replaced inside the glove box in a pure argon atmosphere.

The procedures are listed below:

1. Inside the argon filled glove box, the VacIon pump is replaced. A new Tee valve is installed for pump down (See Figure 1). Make sure that the Tee valve is closed before removing the SEM from the glove box. The torgue required for tightening the bolts is about 130 ounce-inch.

   Since argon is an odorless inert gas, caution should be exercied by venting it outside, or to a well ventilated room in order to prevent asphyxiation of workers.
2. The argon inside the SEM is pumped down first by a Welch Duo Seal Vacuum pump then by a Sargent-Welch Turbo-Molecular pump Model 3120S (See Figure 2). After a few hours of pumping, a good vacuum of 10^{-6} Torr is achieved as monitored by a cold cathode gauge.
3. The SEM and the VacIon pump are wrapped with a heating tape for baking at $200^{o}C$ under hard vacuum for 170 hours or seven days. The temperature is monitored by Thermo Electric Minimite thermocouples (See Figure 3).

Finally the Tee port toward the Turbo-Molecular pump is closed and the VacIon pump is turned on to maintain the 10^{-8} Torr vacuum.

We have successfully replaced two defective VacIon pumps. One of them has been in operation as SE700 in the High Intensity Area of Proton West since November 1978.

We appreciated the support and encouragement given to us by T. Murphy and K. Stanfield.

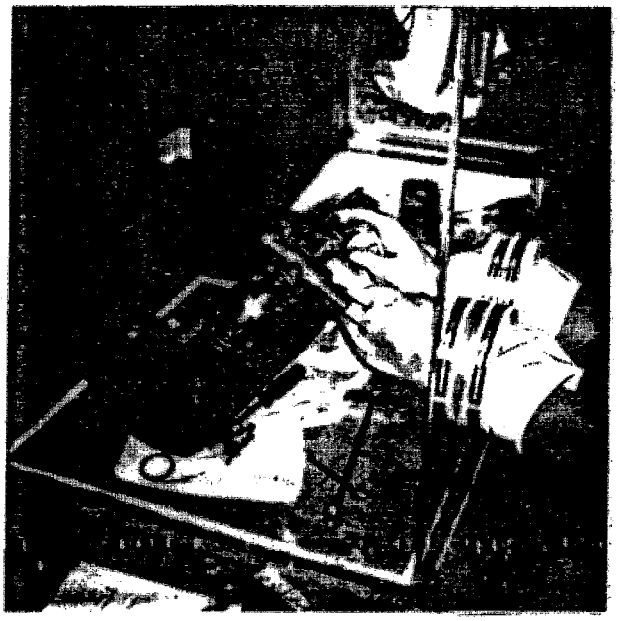

Fig. 1 Replacing the VacIon Pump inside a glove box.

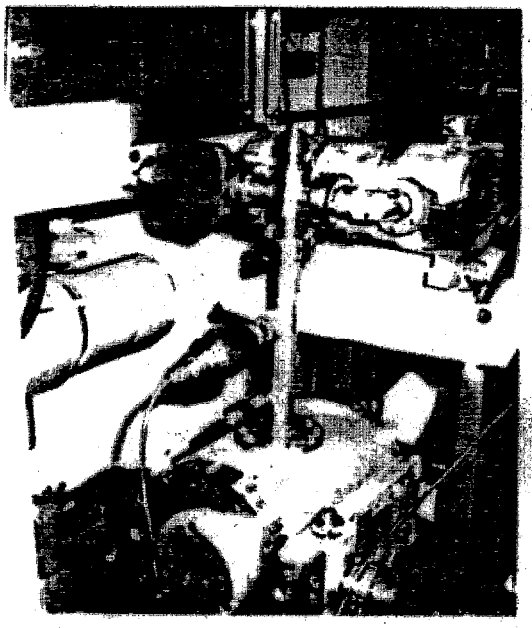

Fig. 2 Pump down by a Turbo-Molecular Pump.

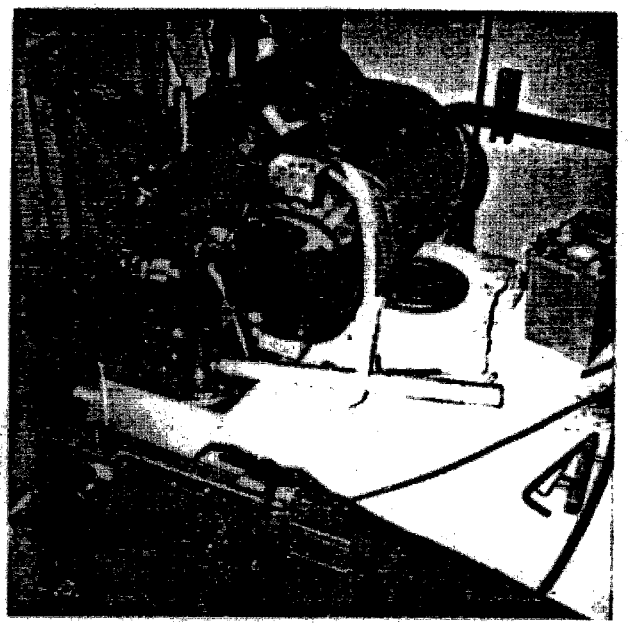

Fig. 3 Baking at 200°C. under hard vacuum.